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February 9, 1959

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Subject: Proposal for Water Activated Battery Study

Reference: Contract RD-107
Task No. 6

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Dear Sir:

Pursuant to our discussions with your cognizant technical representative and encouraged by the results of previous investigations, the [redacted] is pleased to submit the following quotation and attached technical proposal. 25X1

We propose to perform studies on a much larger battery than produced under Task 6, our requisition [redacted], to demonstrate the feasibility of developing and testing performance under severe environmental temperature conditions, greater load currents, and with several electrolytes. When these feasibility studies are completed and final design optimized, six battery cases and thirty complete sets of chemical recharge foils will be fabricated and delivered for evaluation. To facilitate testing, instructions on proper handling, activation, deactivation, and temperature control will also be provided. Complete technical details can be found in our Exhibit "A", "Proposal for Water Activated Battery". 25X1

It is estimated that these efforts will require approximately eight months. It is requested that immediate advanced authority be provided to place an order for 100 square feet of silverclad magnesium foil at an approximate total price of $750, as present information from our suppliers indicate a 90-day backlog in delivery. This foil is critical to this study and should be on hand 30 days after work has begun. If it is impossible to authorize this advanced purchase, it is likely that a delay in delivery could occur.

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PROPOSAL

FOR

WATER-ACTIVATED BATTERY

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1. Past Achievements

The purpose for initiating a feasibility study program on a water-activated magnesium silver chloride system in 1958 as well as all pertinent information on its small scale realization can be found in the Abstract summary and sections IV-D and V-B, (pp. 2, 3, 34, 35; 47-63; 81, 82) of the Annual Report on the Energy Sources Study, Period; July 1, 1957 to June 30, 1958; [redacted]. Of the various geometries investigated, we shall summarize here the performances of only one, for easy reference. Run No. 33 (page 61, Fig. 30), illustrates the load characteristics and chemical rechargeability of a 9-cell battery, with cell areas of 1.875 square inches. This battery was subjected to an intermittent discharge, delivering 0.283 Ampere-hours during a 60 minute period (average current 0.283 A) with peak loads of 0.5 A and with load voltages in excess of 12 V at all times. During this run, voltage fluctuations varied from a maximum value of 14% at the beginning of the run down to 6% at the end. A 3% sodium chloride solution was used as the electrolyte and, although this test was performed at room temperature, the average battery temperature increased to 55°C. 25X1

Although the present state of the art on this type of chemically rechargeable battery includes only the study of the room temperature performance of

sizes equal to or smaller than the one previously mentioned, we believe in the potential flexibility and adaptability of this system. Our experience seems to indicate, in particular, that substantially larger batteries can be made to perform satisfactorily at a wide variety of operating conditions.

2. New Requirements

Encouraged by our previous results, we propose the following:

Phase I: To demonstrate the feasibility of a much larger battery of the same type, delivering an average current of 3 A, for at least 60 minutes at 12 V and at room temperature, using the standard 3% salt solution as electrolyte. Under those conditions the voltage regulation is to equal or surpass the stability previously obtained, except that the maximum load current, for which such stability is desired, is now 5.3 A. instead of 0.5 A.

Phase II: In addition to the standard operating conditions described, a reasonably satisfactory performance of this battery at environmental temperatures of -40°C and +40°C is to be demonstrated. It is recognized, however, that such performance cannot be expected to match that at room temperature. Such experimentation should also include the use of different electrolytes such as tap water and others.

Phase III: Upon completion of the feasibility studies I and II and adoption of a finalized design, 6 battery cases and 30 complete sets of chemical recharge foils are to be fabricated and delivered to the sponsor, including instructions on the proper handling, activation, de-activation, temperature control, etc., for the purpose of conducting field tests.

3. Technical Program Outline

The increase in current rating by a factor ten, contemplated in Phase I, requires the use of much larger cell surface areas. Our initial design for this new battery calls for an active surface area of 20 square inches (2-1/2" x 8"). The evolution and removal of the hydrogen gas through the substantially higher electrolyte layer (2-1/2") is not expected to require any drastic changes in design. On the other hand, the removal of excess heat, necessary for adequate temperature control, will require a change in design. The importance of this heat exchange problem becomes even more obvious if we consider the temperature requirements of Phase II. Since the lower limit of -40°C is substantially below the freezing points of our electrolytes, a certain minimum amount of internal heat generation is essential to a successful discharge cycle. In addition to the external load, which may or may not prevail, this requires the establishment of a controllable internal discharge, to regulate this heat supply. Based on the dimensions, previously mentioned, the size of the battery case is likely to be about 9" x 3" x 1-1/2".

The items of investigation listed below, will proceed for an anticipated period of approximately eight (8) months.

1. Feasibility study of a large model chemically rechargeable magnesium-silver chloride battery, the requirements of which have been specified under Phase I.
2. A testing program of the battery, developed in Phase I, for the purpose of determining the performance of this battery under adverse temperature conditions and the use of different electrolytes as stated in Phase II. As a result of this,

changes in design or operating procedure shall be made to optimize said performance.

3. The production and delivery of prototype batteries complete with recharges and instructions as stated in Phase III.

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The total estimated selling price on a CPFF basis for this study, the advanced purchase of silverclad magnesium foil, and the fabrication of batteries is $21,489.81. Exhibit "B" furnishes a breakdown of the selling price.

It is expected that this work will be unclassified and added as a new task order under existing Contract RD-107. In order to properly plan our manpower commitments, it is necessary to limit this proposal to 60 days. A written extension may be effected thereafter.

Should you desire any further information or any clarification of this quotation, please call me.

Very truly yours,

[redacted] 25X1

Sales Manager - Advance Developments

JAG/rmk
Attachments

CC: [redacted] 25X1
Contracting Officer